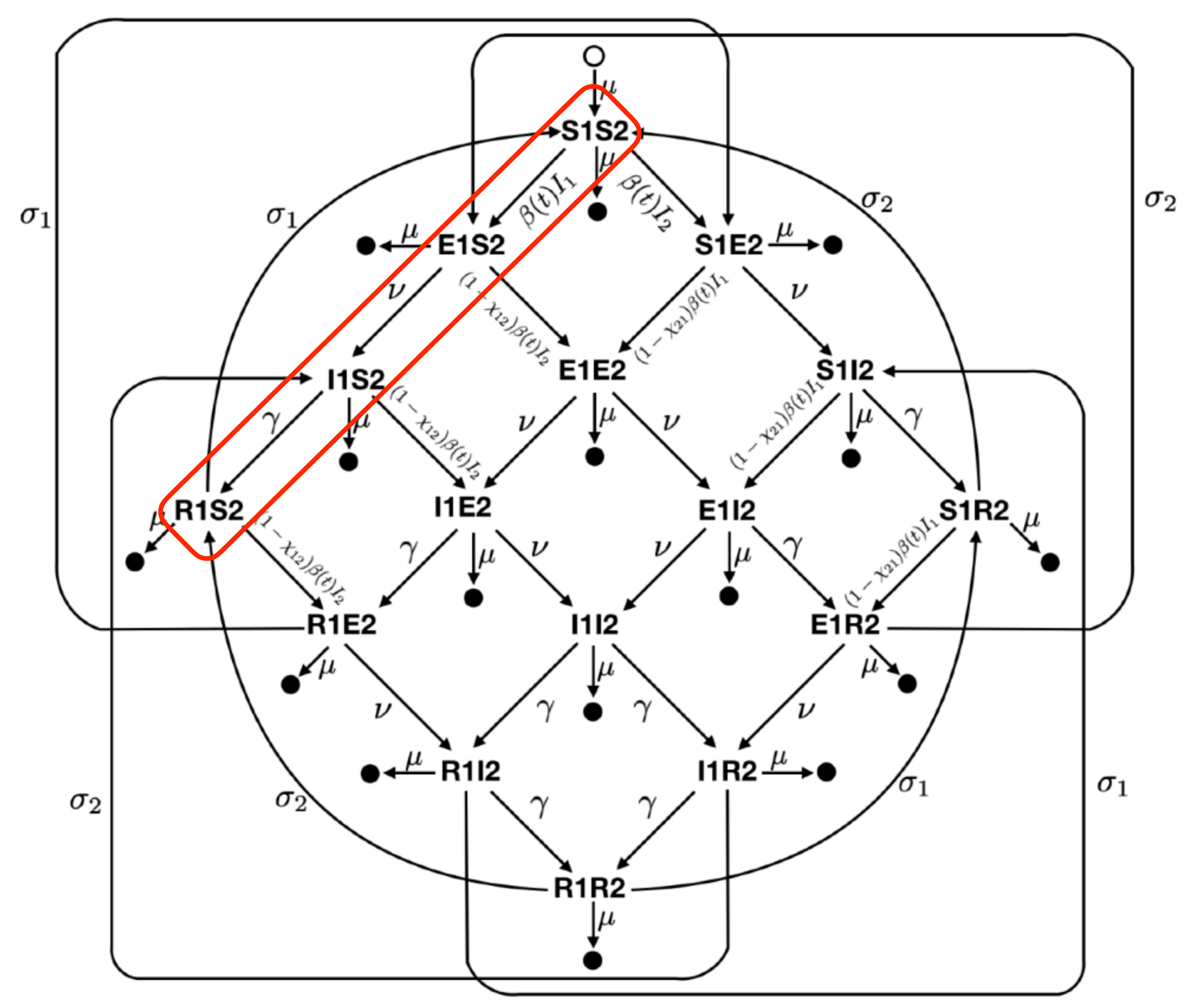


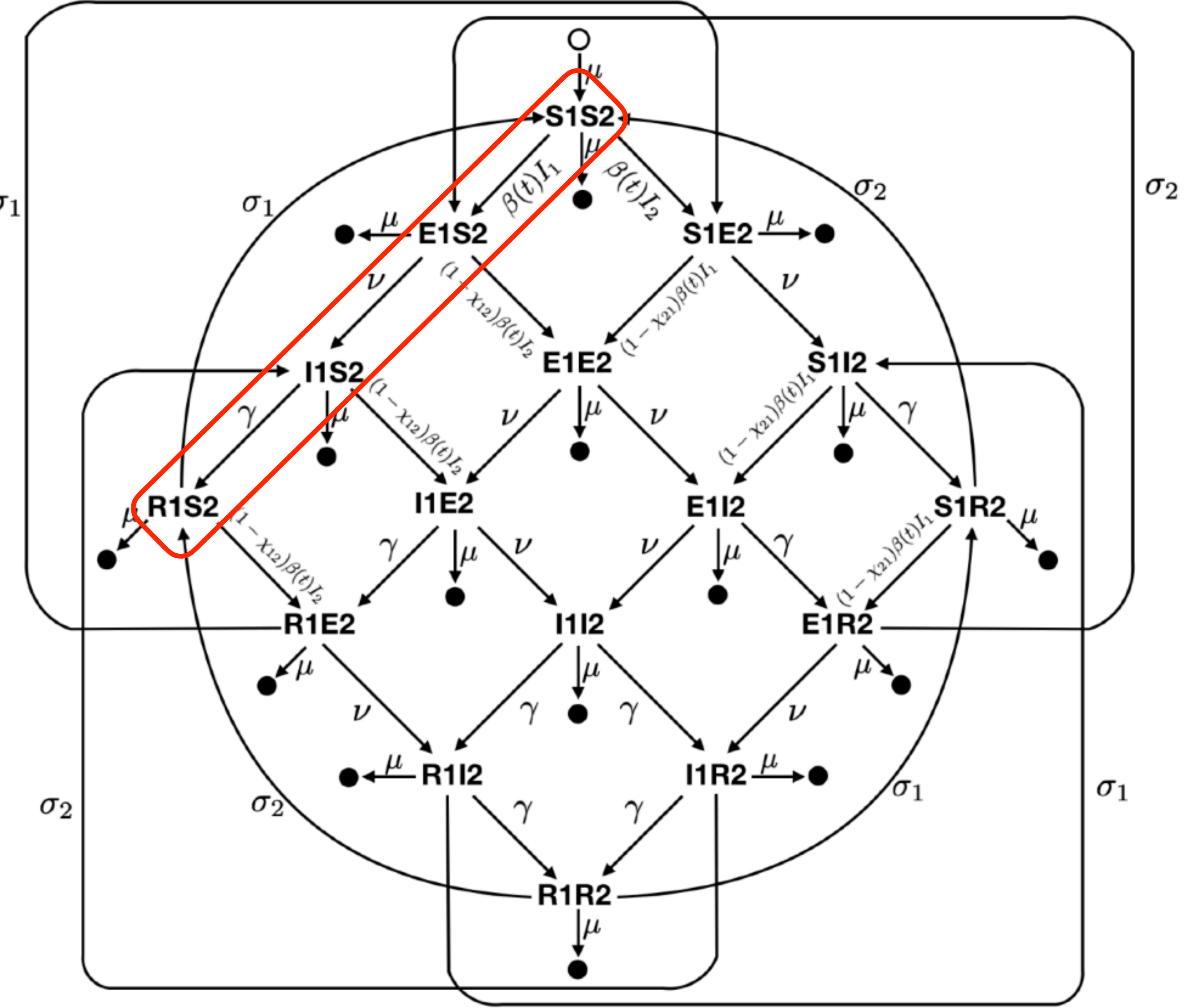
# The full model



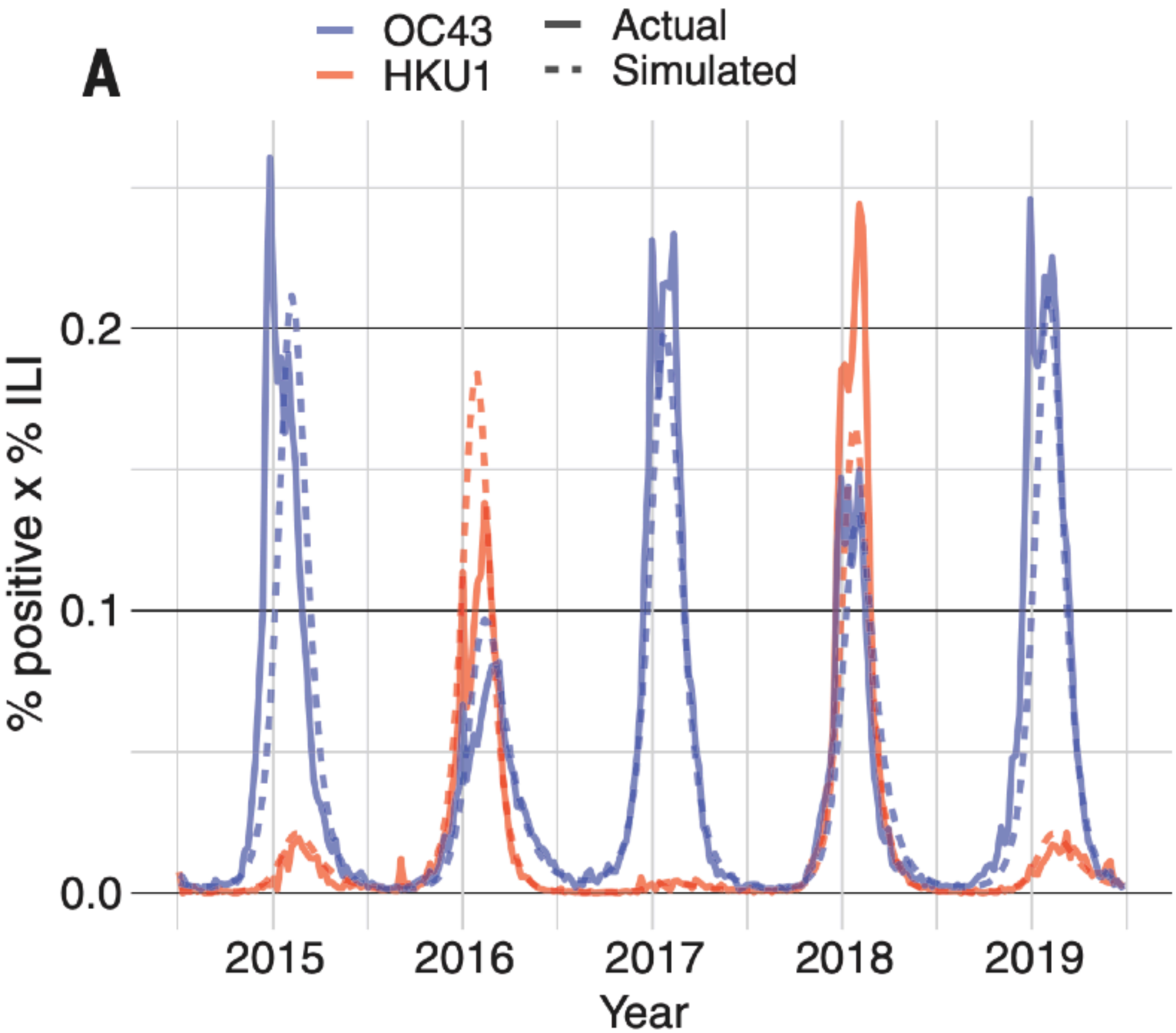
## Includes:

- Waning immunity ( $\sigma$ )
- Partial cross-immunity ( $\chi$ )
- Seasonality ( $\beta(t)$ )

# The full model



Pretty good fit to the available data:



50% cross immunity HKU1 → OC43  
80% cross immunity OC43 → HKU1  
R0 range 1.7 (summer) – 2.2 (winter)  
45-week immunity